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ANNALS OF PHYSICAL MEDICINE

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ORIGINAL PAPER

REHABILITATION OF FRACTURES OF THE SHAFTS OF THE TIBIA AND FIBULA

BY P. J. R. NICHOLS AND J. G. PARISH*

From the Royal Air Force Medical Rehabilitation Units, Chessington and Collaton Cross

SOON after the outbreak of the Second World War it became imperative that injured flying personnel should be made fit for duty with a minimum of delay. Initially an increase of 16% in the number of aircrew returned to duty was achieved by setting up a rehabilitation department within the precincts of the R.A.F. Officers' Hospital at Torquay (Houlding, 1941). It was soon found, however, that far better results could be achieved at residential rehabilitation centres in the country or by the sea, away from the normal hospital atmosphere. By the end of the war ten such centres were established in the Royal Air Force, and the pattern had been adopted by the U.S. Army and the Australian and Canadian Forces. In the European theatre of operations alone the U.S. Army maintained some 13,000 beds for reconditioning (Stewart, 1949). After the war it was considered worth while to maintain three residential rehabilitation centres with a total of 600 beds for the peace-time needs of the R.A.F.

The Piercy Committee of Inquiry on the Rehabilitation of Disabled Persons (1956) has stressed that "the earliest possible return of the disabled to the normal life of work and leisure has a high priority in the task which the State assumes for economic and humanitarian reasons". The Committee recommended the establishment of comprehensive centres at which hospital rehabilitation departments and industrial rehabilitation units are combined on the same site. Such centres were considered to be probably the logical development of the principle

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that rehabilitation is a continuous process from the initial treatment of the injury in hospital until the patient is once more able to work. Centres of this type have already been in operation in the R.A.F. for fifteen years, and the time is opportune to present the results of the rehabilitation of fractures of the tibia and fibula. Before the war these fractures were the third most serious cause of prolonged incapacity after injury (Griffiths, 1935). Fractures of the shafts of the tibia and fibula have been selected for study because there is no direct involvement of a joint, and thus may be regarded by many as not requiring the complex and costly organization of rehabilitation units.

Opportunity for statistical analysis of the results of treatment at R.A.F. centres is unsurpassed. Not only are there large numbers of the same age group under treatment at the same time, but the approach to treatment and assessment has been standardized for many years. Findings, such as the incidence of post-plaster oedema, at different units have been almost identical (within 1%). Consequently the efficacy of new methods of treatment can be readily assessed.

In Service patients the duration of rehabilitation may be prolonged by several factors:

(1) The patient may not be anxious to return to duty if his home is nearer the centre than his normal Service station.

(2) Financial problems are uncommon, since patients continue on full pay.

(3) Standards of fitness required before return to duty are usually higher than those which determine whether or not a civilian is fit to return to work.

(4) Most of the patients are in the 20-30 age group. It has been shown that in civilian life before the war patients in this age group do not invariably recover more rapidly from their injuries than the 30-50 age group (Griffiths, 1935). Family responsibilities and the more mature personality of the older patients may encourage earlier return to work.

We propose to outline the procedures which have been developed at the R.A.F. Rehabilitation Centres to overcome the problems encountered in the after-care of fractures of the tibia and fibula. These observations are supported by statistical analysis of our records in order to assess those factors which tend to delay or hasten recovery out of plaster and, in particular, to select the best method of preventing and treating post-plaster oedema.

PRINCIPLES OF REHABILITATION OF FRACTURES OF THE LOWER LEG

In the Royal Air Force rehabilitation of diaphysal fractures of the tibia and fibula starts as soon as the fracture has been reduced and immobilized. While

the patient is still in hospital with the fracture immobilized in a padded plaster he is taught quadriceps drill and toe-mobilizing exercises. Normally, when the padded plaster is replaced by a non-padded plaster the patient travels to a rehabilitation unit.

Since the early days of rehabilitation in the R.A.F. it has been considered that early transfer to the rehabilitation units confers the following advantages: (a) the patient is under continuous medical supervision throughout his period of rehabilitation; (b) he is in an atmosphere of activity and recovery, where he is encouraged to forget his disability and is prepared for the intensive and detailed programme which follows when the fracture is soundly united; (c) the exercise regimen in plaster reduces wasting of the leg muscles, prevents development of bad walking habits in the plaster, and shortens the period of treatment after removal of plaster. The impression has also been gained that the clinical results, both functional and psychological, are better in patients treated at the rehabilitation units during their period of immobilization than in those who were not.

At the rehabilitation unit the patient starts a routine of group exercises and remedial games, and particular attention is paid to teaching the correct method of "crutch walking".

WALKING IN PLASTER

Even if the patient is still not bearing weight on the injured leg, it is considered important to see that the injured leg swings through correctly and an even rhythm is maintained. When the fracture is ready to bear weight through the plaster, bad walking habits may be established unless the walking apparatus is correctly applied. The spring and lift of the sound leg should be sufficient to allow the splinted leg and rocker to swing through vertically when the sound leg is taking weight. Correct walking requires good power and spring of the sound limb, and good power of the glutei on the injured leg to level the pelvis when rocking over the immobilized limb. For this reason gluteal exercises, extension and abduction of the hip are introduced in the early stages.

The common faults in walking in plaster are: external rotation of the leg as the weight is taken on the injured limb, and circumduction of the injured limb.

REHABILITATION AFTER REMOVAL OF PLASTER

When the fracture is soundly united and the plaster is removed the problems of rehabilitation are: (a) redevelopment of wasted muscles, particularly the calf and quadriceps; (b) mobilization of knee and ankle joints; and (c) re-education in walking.

The first few days after removal of the plaster are devoted to individual

supervision of walking, starting on crutches and gradually increasing the weight taken by the injured leg, and graduating to a pair of walking-sticks when the patient is confident. The walking-sticks are used primarily to maintain balance and help re-establish a walking rhythm. "Two sticks or none at all" is the guiding rule. This first week is of great importance in establishing the patient's confidence in his leg. If he is allowed to rehabilitate himself, every slight twinge of pain due to muscle or joint stiffness is liable to be interpreted as possible damage to the fracture site, and the fracture will be refractured many times in the patient's imagination. This can only delay the re-establishment of a walking rhythm, so that any tendency to limp persists and may take weeks to correct. Our maxim is: "Make the patient forget his injury, while never forgetting the injury oneself." The normal mechanism is explained to the patient, and defects are analysed and demonstrated. A full-length mirror is an essential piece of equipment. The exercise routines are practised at a steady rhythm and a limp-free walk is insisted on at all stages, even though it may be slow and short-paced at first.

Once confidence has been restored the patient takes part in class exercises at a strict rhythm. These are based on the movements of normal walking with patterns repeated, exaggerated, or reversed, and are best practised wearing shoes and on a firm floor. As a supplement, exercises for muscle building and joint mobilization are also employed during this phase of rehabilitation, but the emphasis is on the establishment of a limp-free walk.

When the patient can walk with almost even paces without the use of sticks he is ready to move on to a class designed to develop spring in walking, leading up to the early stages of running and jumping. The key to success at this stage is the development of the power of the calf muscles, but at the same time the patient has to learn to co-ordinate these muscles in the basic reflex patterns of movement, on which re-education of normal activities depends. The final exercise programme includes tests of agility, walking over rough ground, and running. Before discharge patients are expected to be able to cover a five-mile cross-country course.

PRESENT SERIES

The results and opinions expressed in this paper are based on an analysis of the medical records of 555 patients made up as follows: (a) those treated at the Royal Air Force Medical Rehabilitation Unit, Chessington, between October, 1946, and December, 1953 (303 cases); and (b) those treated at the Royal Air Force Medical Rehabilitation Unit, Collaton Cross, between January, 1953, and December, 1956 (252 cases). The age incidence and causes of injury are shown in Table I.

TABLE I
DETAILS OF SERIES

Age range:				
Under 20 years	..	..	..	33%
20-30 years	..	..	..	57%
Over 30 years	..	..	..	10%
Types and causes of accident:				
Motor-cycle accidents	..	..	..	34%
Other road accidents	..	..	..	7%
Football	..	..	..	27%
Service accidents	..	..	..	6%
Rugby football	..	..	..	6%
Other causes	..	..	..	20%

RESULTS

CLINICAL UNION

The period in plaster depends on the rate of clinical union. Clinical union was considered to have occurred when the fracture was no longer tender and resisted springing without pain. Radiological consolidation was never complete at this stage, but so long as there was a continuous bridge of callus of sufficient width and breadth across the fracture site the plaster was left off.

The time for clinical union did not differ significantly from that recorded by Watson-Jones and Coltart (1943).

Time Required for Clinical Union (weeks)	Present Series (%)	Watson-Jones and Coltart (%)
Under 12	23	23.7
12-24	56	53.7
Over 24	21	22.6

Detailed analysis (Table II) shows that compound injuries and the more severe injuries with comminution tend to delay clinical union, and the inclusion of fractures of the tibia alone significantly affects the average time for clinical union. In a consecutive series of lower-leg fractures simple fractures of the tibia alone constituted 25% (Parish, 1957). Lundgren (1936) noted that 25% of diaphysal fractures were undisplaced and united more rapidly than the others. For the rest of the survey fractures of the tibia alone have been disregarded.

Many authorities believe that traction is a potent source of delayed union (Albert, 1944; Watson-Jones and Coltart, 1943). However, traction is usually reserved for the more severe injury with comminution, and, as Ellis (1958a) has pointed out, it is dis-traction rather than traction which is the cause of delayed union. Although major fractures treated with traction did, on an average, take

TABLE II
DETAILED ANALYSIS OF TIME REQUIRED FOR CLINICAL UNION IN CASES OF
DIAPHYSIAL FRACTURE OF TIBIA ACCORDING TO TYPE OF FRACTURE AND
TYPE OF REDUCTION

	Time in Weeks Required for Clinical Union				
	Less than 12 (%)	12-15 (%)	16-19 (%)	20-23 (%)	24 and over (%)
Closed reduction:					
Simple fracture	40	23	15	12	10
Compound fracture	7	39	17	10	27
Comminuted fracture	14	25	25	11	25
Total closed reduction	30	25	17	12	16
Early open reduction	13	27	29	8	23
Delayed open reduction	—	11	19	13	57
Simple fracture of tibia and fibula—all types of reduction	22	26	22	9	21
Fracture of tibia alone	60	23	10	1	6
All cases	23	24	20	12	21

longer to unite, there was no increase in the incidence of delayed union or non-union. In the present series it was not possible to analyse retrospectively the degree of dis-traction; however, it was noted that 50% of the fractures treated by traction for more than one month had not united within six months.

The importance of accurate reduction is also illustrated by the finding that persistent angulation of more than 5 degrees was associated with a clinical union time of more than six months in 33% of cases; and lateral displacement of more than 1 cm. (0.4 inch) was associated with a clinical union time of more than six months in 37% of cases (Parish, 1957).

MOBILIZATION TIME

The term "mobilization time" has been used to describe the number of weeks from removal of the plaster until the patient is fit for discharge. The mobilization time is very variable and depends on many factors—anatomy, temperament, and the standard of fitness required all play a part. The main factors affecting mobilization time are shown in Table III.

Slow or delayed union was associated with a slight increase in mobilization time (see Table IV). Delay of more than six months not only increases the time required for mobilization, but also leads to inferior end-results.

The time of transfer to the rehabilitation unit is important. Patients transferred to a rehabilitation unit more than 28 days before removal of the

TABLE III
SUMMARY OF FACTORS PROLONGING MOBILIZATION PERIOD OF FRACTURES
OF SHAFT OF TIBIA AND FIBULA

	Mobilization Period (Weeks)
(a) Time of transfer to rehabilitation unit:	
Early transfer	9
Late transfer (after third post-plaster week)	16
(b) Type of reduction:	
Closed reduction:	
Simple fractures	8
Compound fractures	11
Open reduction:	
Early operation	10
Delayed operation	15
(c) Post-plaster oedema:	
Without oedema	9
With oedema	13
(d) Fractures treated with continuous traction	14

plaster had an average mobilization time of nine weeks. Patients transferred for rehabilitation more than 21 days after removal of the plaster had an average mobilization time of 16 weeks, whereas the average corresponding time for all other patients was still only nine weeks.

TABLE IV
EFFECT OF DELAYED UNION ON MOBILIZATION TIME

Time Required for Clinical Union (Weeks)	Mobilization Time (Weeks)
Under 12	9
12-24	9
Over 24	11

Oedema occurring after removal of the plaster-of-Paris was the most important delaying factor (Table V).

TABLE V
EFFECT OF POST-PLASTER OEDEMA ON MOBILIZATION TIME
(i.e. time after removal of plaster to functional recovery)

Type of Reduction	Average Mobilization Time (Weeks)	
	Without Oedema	With Oedema
Closed reduction	9	11
Early open reduction	9	12
Delayed open reduction	14	22

KNEE MOBILIZATION

The rate of recovery of knee flexion and ankle movement was estimated in 54 patients after removal of the plaster at the rehabilitation unit (Parish, 1957). Most patients had regained knee flexion to 50 degrees by the end of the third week, but those with fractures immobilized for more than six months required 12 weeks or more to regain this amount of knee bend. The three patients who had not obtained flexion to 50 degrees at the time of discharge had all been in plaster for more than five months. Prolonged immobilization of the knee-joint is, therefore, not altogether harmless.

ANKLE MOBILIZATION

In the normal ankle full dorsiflexion was found to vary from 86 to 65 degrees and plantar flexion from 135 to 160 degrees. The range of movement was 66 ± 8 degrees. Although in many patients the range of joint movement of the uninjured leg remained unchanged during treatment of the fracture, frequently the range increased; in one patient an increase of 18 degrees was recorded. Thus, comparison of the injured ankle with the normal one is an unreliable method of recording progress during rehabilitation.

The range of ankle movement on removal of the plaster was, on an average, 41 degrees for patients immobilized for less than 12 weeks, 34 degrees for those immobilized for 12-16 weeks, and 32 degrees for those immobilized for more than 16 weeks. Immobilization for more than three months has little effect on the initial ankle range.

The lower limit of normal plantar flexion (135 degrees) was reached within the first post-plaster week in 50% of patients immobilized for less than three months, but not until the fifth week when the time in plaster was over six months. Recovery of dorsiflexion depended on the position in which the foot was immobilized, fixation in plantar flexion delaying recovery. Five degrees of dorsiflexion, the range required for a limp-free walk, was regained by 90% of patients in three to seven weeks, depending on the duration of immobilization. Recovery of ankle movements occurred most rapidly in patients with fractures which had been immobilized for less than 12 weeks. For longer periods of immobilization the rate of recovery was almost constant.

The treatments most effective in regaining ankle movements in the first week of mobilization were those which eliminated or counteracted the effects of gravity—i.e. bed rest (16 degrees), elastic bandage (14 degrees). Patients treated by class work alone, or with a crêpe bandage, gained only 9 degrees in the first week. Neither duration of immobilization nor the initial range had a significant effect on the gain in movement during the first week out of plaster (Nichols, 1956).

Of our total series of patients 84% were recorded as regaining full ankle movements. There was little difference in the rate of recovery of patients transferred to the rehabilitation unit after removal of the plaster compared with those treated at the rehabilitation unit in plaster, with the exception of those patients arriving later than the third post-plaster week, who appeared to be taking two or three weeks longer to reach each stage.

POST-PLASTER OEDEMA

The incidence of post-plaster oedema throughout the series was 23%. Analysis of the results according to the type of fracture, the type of reduction, and the time of transfer from hospital to rehabilitation unit showed that the lowest incidence of post-plaster oedema (16%) occurred in cases of simple fracture treated by closed reduction and transfer to the rehabilitation unit while still in plaster. The incidence of oedema was 30-35% after compound fractures and after open reduction. Delayed operation was more likely to be associated with oedema than early operation. For each type of fracture or reduction, delay in transfer to the rehabilitation unit till after clinical union was associated with a significant increase in the incidence of post-plaster oedema. Thus post-plaster oedema is probably the most important single factor affecting mobilization time, for it is increased in those conditions which have been shown to be associated with an increase in mobilization time.

PREVENTION OF POST-PLASTER OEDEMA

The incidence of post-plaster oedema also varied according to the routine adopted after the removal of plaster. The incidence of post-plaster oedema in 167 cases treated without routine post-plaster management was 25%. When the treatments were at the discretion of the medical officer and based on individual assessment (218 cases) the incidence was 18%. In 97 patients treated with routine application of Elastoplast over stockinette the incidence was 16%. The most effective method of preventing oedema was the routine use of a Scott-Curwen bandage as described below, where in 43 consecutive cases the incidence was reduced to 9%.

MANAGEMENT OF ESTABLISHED POST-PLASTER OEDEMA

The case histories of patients treated in the early years of the series have been analysed to assess the results of various methods of treating established post-plaster oedema. The most effective methods were:

- (a) Vigorous and time-consuming physiotherapy consisting of centripetal massage and faradism under pressure twice daily. The patients wore a crêpe bandage at all other times.

- (b) Routine use of an elastic webbing bandage. The bandage used was of the type described by Curwen and Scott (1952), and was applied from the metatarsal heads to the neck of the fibula. It was applied immediately after removal of the plaster and worn continuously.

The other treatments used included the application of (i) Viscopaste, (ii) Elastoplast, (iii) a combination of Elastoplast for the foot and ankle and crêpe bandage above the ankle, and (iv) crêpe bandage alone. The effect of the various treatments, showing the average duration of oedema for each group, is given in Table VI.

TABLE VI
TREATMENT OF ESTABLISHED POST-PLASTER OEDEMA IN DIAPHYSIAL FRACTURES OF TIBIA AND FIBULA

	Mean Duration of Oedema (Weeks)
No definitive treatment	6
Viscopaste	6
Crêpe bandage	4
Elastoplast	3
Elastoplast for ankle and crêpe bandage above	3
Elastic webbing bandage	2
Vigorous and time-consuming physiotherapy	2

RELATIONSHIP BETWEEN POST-PLASTER OEDEMA AND OSTEOPOROSIS

We gained a clinical impression that severe and persistent post-plaster oedema was associated with the patchy decalcification of the tarsus and marked decalcification of the lower end of the tibia at the time of removal of the plaster.

A simple estimation of the ratio of the density of radiographs of the upper and lower ends of the tibial shaft was carried out in 22 normal subjects, 21 patients with fractures of the tibia and no post-plaster oedema, and 39 patients with post-plaster oedema.

X-ray Analysis of Tibial Shafts.—Standard radiographs (using intensifying screens) of the whole tibia were studied. A Weston photoelectric photographic light meter was used to give a measure of the relative density of the lower fragment in terms of the upper fragment. This "density ratio" is a measure of the relative thickness of the upper and lower ends of the tibia and of the soft tissues, and of the calcification. Films which were underexposed, overexposed, underdeveloped, or overdeveloped were rejected, as a preliminary assessment on poor-quality films showed that faulty technique tended to lessen the difference in density of the film of the two ends of the tibia, giving a density ratio less than that of a good-quality film taken at the same time.

The results are given in Table VII. These confirm the clinical impression

that most patients who develop post-plaster oedema have a relative decalcification of the lower fragment. However, one-third of the patients with oedema did not show decalcification. It is suggested that this group may have oedema due to mechanical factors, whereas those with decalcification may have a neurovascular disturbance.

TABLE VII
RATIO OF DENSITY OF RADIOGRAPHS OF UPPER AND LOWER ENDS OF TIBIAL SHAFT

	Number of Cases	Mean Value
Normal subjects	22	1.6
Patients with fracture but no oedema ..	21	2.48
Patients with fracture and oedema	39	4.05

Difference between normals and patients with fractures but no oedema, $t_{41}=4.65$; $P<0.001$.

Difference between normals and patients with fractures and oedema, $t_{50}=5.0$; $P<0.001$.

Difference between fractures without oedema and fractures with oedema, $t_{58}=3.03$; $P<0.01$.

CALF-MUSCLE POWER

The activity of the calf muscle is as important for the control of the ankle-joint as the more familiar quadriceps action for stability of the knee-joint. From time to time patients are seen in whom there is a delay in recovering calf-muscle power and the associated ability to raise the heel of the injured leg off the floor. These patients present a difficult problem, and many exercise techniques have been tried.

Recently a small series of these patients has been treated with isometric exercises performed against a spring balance. The technique consisted in the patient performing 18 maximal contractions at half-minute intervals twice daily. On such a regimen calf-muscle power, on an average, almost doubled by the end of the fourth week. These preliminary results indicate that isometric exercises may well be a useful routine in the later stages of rehabilitation after fracture of the tibia.

RECOVERY OF FUNCTION

Estimation of the mobility of the ankle and foot is of little value in assessing progress after fractures of the tibia and fibula. A patient with a mobile, pain-free ankle may still walk with a marked limp; it is the recovery of the power and co-ordination of the calf muscles which diminishes the tendency to limp. A simple and comparatively accurate method of measuring calf-muscle action is to assess the patient's ability to stand on the toes of the injured leg only, at first with, and later without, assistance. The stages adopted in a detailed survey of 74 diaphysal fractures (Parish, 1957) were so arranged that ability to stand on

the toes of the injured limb could be correlated with recovery of ability to walk and run, with and without a limp. The results are summarized in Table VIII.

TABLE VIII
FUNCTIONAL RECOVERY AFTER FRACTURES OF TIBIA AND FIBULA
(Patients Treated during Plaster Stage)

Time Immobilized (Weeks)	Time in Weeks After Removal of Plaster		
	Able to stand on toes	Able to walk without limp	Able to run with minimal limp
Less than 12	5	6	6
12-16	6	9	8
16-24	6	8	9
Over 24	19	21*	14*

* Not all patients reached this stage on discharge.

The most rapid return of function was seen in patients immobilized in plaster for less than 12 weeks. These patients were able to walk with a minimal limp about four weeks after removal of the plaster, to stand without difficulty on the toes of the injured leg only a week later, and to run with minimal limp and walk normally after a further week. Patients from 12 to 24 weeks in plaster took only one to two weeks longer to pass these stages, but after six months in plaster the delay was much greater.

For patients with less than 16 weeks' immobilization there was little difference in the rate of attaining each of the functional grades, whether the patients had been transferred to the rehabilitation centre before clinical union or not. Delay in transfer for rehabilitation of up to three weeks after removal of plaster was associated with an initial delay in return of function; but the patients quickly caught up with the others in their rate of progress. Patients who had been immobilized for 16 weeks or more showed more marked differences. Those transferred for rehabilitation after a delay of three weeks after clinical union took up to seven weeks longer to reach each stage, compared with similar patients treated in plaster. There was no tendency for the late arrivals in this group to catch up with the others, and a higher proportion failed to achieve the more advanced tests of recovery, such as walking without a limp and running.

One of the striking features of the recovery of function shown by these analyses is that, in general, walking without a limp was the last of the abilities to be regained. Only in-patients treated at the rehabilitation unit for more than one month in plaster, or patients whose period of immobilization in plaster was less than 12 weeks, attained a normal walk *before* they were able to run with even steps. This rather remarkable finding bears out our clinical impression

that prolonged immobilization and lack of proper walking training in plaster lead to the development of a "habit limp". This habit limp is unrelated to the regaining of joint mobilization or power; and the rate at which the ability to run is regained is a direct measure of the efficiency of routine rehabilitation. The recovery of a limp-free walk represents the achievement of rapid clinical union, adequate correction of bad walking techniques while in plaster, and strict attention to walking re-education during rehabilitation.

DISPOSAL

Disposal of the patients in the present series was as follows: returned to full duty, 77%; returned to modified duty, 18%; invalided from the service, 5%.

DISCUSSION

The main problems which we have encountered in the rehabilitation of patients with fractures of the tibia and fibula have been: (1) the prevention of a faulty gait whilst the patient is in plaster; (2) the establishment of a limp-free walk after the plaster is removed; (3) the development of calf-muscle power and co-ordination on which agility depends; and (4) the prevention and treatment of post-plaster oedema. Once a limp has become a habit its correction is difficult and time-consuming. One of the most important reasons for the transfer of patients to a rehabilitation centre while in plaster is that correct walking can be taught. Once the patient can walk correctly, is using his limb as freely as the plaster allows, and static quadriceps exercises are a habit, he is best employed on duties as closely allied to his trade as possible. We have not found any evidence that continued organized exercises in plaster at a rehabilitation centre significantly hasten recovery. However, transfer to a rehabilitation unit while in plaster ensures that patients are at the unit for the important early post-plaster phase. Hospital rehabilitation departments ought to be able to compete successfully with in-patient rehabilitation centres in the treatment of patients in plaster if their more limited facilities for rehabilitation were reserved for teaching walking in plaster and for the treatment of patients in the early post-plaster period.

In the absence of a habit limp, successful walking re-education in the post-plaster period depends on the development of calf-muscle "spring". The ability to perform the progressive tests of calf-muscle function (such as balancing on the toes of the injured leg only and hopping) is a much more accurate indication of the progress of patients than the measurement of joint range or the power of individual muscles.

There is no authoritative study of the possible techniques of improving muscle function, but the three components of muscle action—strength, endur-

ance, and co-ordination—appear to be of equal importance in normal everyday activities (Darcus, 1956). Preliminary experiments at the R.A.F. centres indicate that isometric contractions are the most useful method of building up muscle power. This type of exercise, introduced at the appropriate stage of rehabilitation, should facilitate functional recovery.

Calf-muscle action and oedema were studied separately for convenience, but they are probably closely interlinked. The calf muscles act as a pump, which aids the dispersion of the oedema. The pump is sometimes inadequate, especially when weight-bearing activities are advanced too rapidly; hence it has been customary at R.A.F. rehabilitation centres in the early post-plaster period to alternate weight-bearing activity with periods of exercises with the limb level or elevated.

The efficacy of treatment regimens which eliminate gravity in the regaining of ankle movements suggests that a tendency to oedema is present to a greater or less degree in all cases, ranging from "subclinical oedema" to established post-plaster oedema.

The question arises whether muscle wasting, oedema, and joint stiffness are primarily due to disuse (Watson-Jones, 1952), to phlebothrombosis (Ochsner and Landry, 1952), or to reflex neurovascular disturbances (Fontaine and Herrman, 1933; Casten and Betcher, 1955). In the present survey the incidence of oedema remained constant as duration of plaster immobilization increased. Joint stiffness, however, increased in proportion to the time in plaster. The presence of patchy decalcification in radiographs of the tarsus at the time of removal of the plaster increased the probability of the subsequent development of oedema to nearly three times that expected when the radiographs were normal or showed only slight changes. This finding was independent of the duration of immobilization (apart from a few cases immobilized for over six months) or treatment in plaster at the rehabilitation unit.

The correlation between initial treatment, joint stiffness, vascular damage, and ischaemia has been emphasized by Ellis (1958b). The correlation between osteoporosis and post-plaster oedema found in the present series is of more direct practical importance. If marked osteoporosis of the ankle bones is found on the radiographs taken when the plaster is finally removed, post-plaster oedema is more likely to develop than when osteoporosis is slight. Consequently the mobilization period is likely to be prolonged unless facilities for intensive treatment are available. However, in present conditions the convalescence of the majority of patients can be reduced by many weeks with intensive treatment, particularly in the early post-plaster period. In civilian life, where residential facilities for rehabilitation are limited, it should still be possible to adopt some of the methods outlined above in hospital physiotherapy departments.

SUMMARY

The method of rehabilitation of patients with fractures of the tibia and fibula at Royal Air Force rehabilitation units has been described. The results of rehabilitation of 555 patients with these fractures treated at two R.A.F. rehabilitation centres between 1946 and 1956 have been analysed.

The value of early transfer to rehabilitation centres appears to lie in the teaching of correct walking in plaster, and in having the patients available for intensive treatment during the immediate post-plaster phase. Patients arriving later than the third post-plaster week required considerably longer periods of treatment than the remainder. This difference appeared to be due to the increased incidence of, and delay in dispersion of, oedema. Oedema also developed more frequently in those cases in which osteoporosis was observed on the radiograph taken at the time of removal of plaster. The most effective method of preventing and treating post-plaster oedema was the application of an elastic webbing bandage.

Organized exercises in plaster do not result in quicker return of ability to "spring" and to run when the plaster is removed, but the prevention and correction of a faulty gait in plaster results in a more rapid achievement of normal walking when the plaster is removed. Preliminary experiments suggest that isometric exercises are the most effective technique for increasing calf-muscle power.

The rate of recovery of ankle and foot mobility is of little value in estimating progress after immobilization. Observation of walking and running patterns and testing of ability to "spring" provide an accurate method of assessing the patient's fitness. The tests measure calf-muscle power and co-ordination.

ACKNOWLEDGMENTS

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[References are concluded on page 93]

ORIGINAL PAPER

CHLOROQUINE IN RHEUMATOID ARTHRITIS

By J. F. BUCHAN

From the Royal Northern Hospital, London

FOR the past seven years reports have been appearing on the results of treatment of rheumatoid arthritis with antimalarial drugs. Page (1951) observed that mepacrine (Atebrin; Quinacrine) had a good effect in cases of lupus erythematosus. One of his patients suffered from an arthritis of rheumatoid type, which improved together with the skin lesions. Following this Freedman and Bach (1952) tried mepacrine, but their investigation had to be abandoned because of the objectionable discoloration of the skin that resulted.

Other antimalarial drugs tried in the treatment of rheumatoid arthritis included proguanil (Paludrine) and chloroquine. The former was of doubtful value only, but chloroquine seemed to give benefit with absence of toxic reactions. Following this finding several papers have appeared testifying to its value in the treatment of rheumatoid arthritis. Freedman (1956), Cohen and Calkins (1957), and Rinehart, Rosenbaum, and Hopkins (1957) all reported significant improvement obtained in short-term controlled trials. Bagnell (1957), in a much larger uncontrolled study extending over four years, suggested that chloroquine therapy came nearer to the ideal long-term safe control of rheumatoid disease than treatment with any other agent. Details of the above investigations are given in Table I.

TABLE I

Authors	No. of Patients in Trial	Duration of Trial	Results and Conclusions
Freedman (1956)	66	16 weeks	Controls improved slightly. Chloroquine group made significant but not substantial improvement
Cohen and Calkin (1957)	22	10 weeks	Statistically significant difference between treated group and untreated controls
Rinehart, Rosenbaum, and Hopkins (1957)	33	?	Statistically significant difference between treated group and untreated controls
Bagnell (1957)	125	Up to 4 years	Trial not controlled, but general impression of "a safe and effective long-term agent"

The present investigation was started with the idea of carrying out a long-term controlled trial of the drug, but, owing to the difficulty of keeping patients with active rheumatoid arthritis on dummy tablets for prolonged periods, it was decided to assess the cases after three months and then subject them to a long-term follow-up.

METHOD OF TRIAL

Thirty-eight ambulatory patients with rheumatoid arthritis of varying degrees of severity were given either tablets containing chloroquine sulphate (Nivaquine, May and Baker) or dummy control tablets indistinguishable in every way from the chloroquine tablets. Neither the patients or the investigator, nor the physiotherapists coming into contact with the patients were aware which type of tablet a given subject was receiving. All patients were given such physiotherapy as was indicated, and were allowed to take aspirin as required. No other drug was given.

Table II gives the age and sex distribution, and Table III the duration of disease before the start of the three-monthly treatment period.

TABLE II
AGE AND SEX DISTRIBUTION

Sex	Age Group (years)					All Ages
	Under 40	40-49	50-59	60-69	70-79	
Control:						
Males	—	—	1	—	—	1
Females	3	2	2	5	—	12
Chloroquine:						
Males	1	2	2	2	1	8
Females	1	—	6	5	5	17

TABLE III
DURATION OF DISEASE BEFORE TREATMENT (THREE-MONTHS TRIAL PERIOD)

Group	Duration of Disease (years)				Total
	Less than 1	1-4	5-9	10 and over	
Control	—	5	6	2	13
Chloroquine	2	10	5	8	25

METHOD OF ASSESSMENT

The progress of each patient was followed by means of (1) the "activity index" or "inflammatory quotient", and (2) the joint-spread index, the two indices being calculated on each occasion the patient was seen.

The *activity index or inflammatory quotient* (Lansbury, 1956) consists in the summation of a number of indices, each of which is believed to reflect the fluctuations of the inflammatory process in rheumatoid arthritis. These are: tiredness, stiffness, and the degree of pain experienced as estimated by the amount of aspirin required daily to relieve it (as indicating symptomatic change); grip strength (objective change); and erythrocyte sedimentation rate and haemoglobin level (laboratory tests of rheumatoid activity). Each of these six indices is converted into a percentage and the average figure calculated.

The *joint-spread index* expresses as a percentage of the total joint area the amount of joint involvement present at the time of examination. It does not indicate the activity of the disease, but the "total size" of the pathological joint lesions. In calculating this index use was made of the work of Lansbury and his co-workers, who have estimated in square millimetres the area of articular cartilage contained in each individual joint of the body (excluding the spinal joints).

RESULTS

Results at the end of three months as assessed by the activity and joint-spread indices are shown in Table IV, and these are further analysed in Table V.

TABLE IV
RESULTS AT THREE MONTHS

	Activity Index (%)		Joint-spread Index (%)	
	Chloroquine (25 Cases)	Control (13 Cases)	Chloroquine (25 Cases)	Control (13 Cases)
Initially	68.3	46.5	35.9	19.5
At 3 months	50.7	69.0	28.3	22.6
Percentage change ..	-25.8	+48.4	-21.2	+15.9

Patients were reassessed at six months, but by that time, owing to various causes, there were only 20 chloroquine and 12 control cases. The age and sex distribution of the two groups is shown in Table VI, and the duration of disease in Table VII.

The results in the 32 cases (20 chloroquine and 12 control) remaining in the trial were as shown in Table VIII.

DISCUSSION OF RESULTS

Table IV shows the difference between the two groups at three months; initial values for both indices indicate that the chloroquine group were worse

TABLE V
DISTRIBUTION OF INDIVIDUAL CHANGES IN INDEX AT THREE MONTHS

	Minus							Plus						
	More than 60	60-51	50-41	40-31	30-21	20-11	10-1	0-9	10-19	20-29	30-39	40-49	50-59	60 or more
Activity index:														
Chloroquine ..	5	4	3	2	1	6	1	-	-	1	1	-	-	1
Control ..	-	-	1	-	-	1	1	-	1	-	3	1	1	4
Joint spread:														
Chloroquine ..	5	-	1	2	2	2	1	7	-	-	1	-	1	3
Control ..	-	1	-	-	1	-	-	5	-	1	-	-	-	5

TABLE VI
AGE AND SEX DISTRIBUTION (SIX-MONTHS TRIAL PERIOD)

Sex	Age in Years						All Ages
	Under 40	40-49	50-59	60-69	70-79	80-89	
Control: ..							
Males ..	-	-	-	-	-	-	-
Females ..	1	2	2	7	-	-	12
Chloroquine:							
Males ..	-	1	1	1	1	-	4
Females ..	-	-	5	5	4	2	16

TABLE VII
DURATION OF DISEASE BEFORE TREATMENT (SIX-MONTHS TRIAL PERIOD)

Group	Duration of Disease (years)				Total
	Less than 1	1-4	5-9	10 and over	
Control ..	0	5	3	4	12
Chloroquine ..	4	8	2	6	20

TABLE VIII
RESULTS AT SIX MONTHS

	Activity Index (%)		Joint-spread Index (%)	
	Chloroquine (20 Cases)	Control (12 Cases)	Chloroquine (20 Cases)	Control (12 Cases)
Initially ..	68.2	67.6	34.3	30.5
At 6 months ..	38.8	82.6	21.3	34.0
Percentage change ..	-43.1	+22.2	-37.9	+11.5

than the controls but the average changes were large. It should be noted that before the trial was started all the patients, including the control group, were taking chloroquine, and this may explain the otherwise rather surprising deterioration occurring among the controls.

Table V shows the distribution of actual individual changes. Taking the activity index, all but three of the patients given chloroquine registered an improvement, whilst 10 out of the 13 controls were worse. The joint-spread index showed similar (but not such marked) changes.

Mr. Curwin, statistician to St. Bartholomew's Hospital, has expressed the opinion that on the face of it there seems to be no doubt about the statistical significance of these findings, but that some doubt must be cast on their validity by reason of the lack of balance between the two groups. Obviously there is more scope for improvement to occur among the worse patients, and this gives a bias in favour of the chloroquine group. In addition, the sex ratio varies between the two groups (1 male to 12 females in the control group, against 1 male to 2 females in the chloroquine group). If, however, the comparison were restricted to those patients (8 of each group) whose initial activity index was less than 50 (an arbitrary figure) most of these differences would be eradicated and the following figures emerge:

	Activity Index (%)	
	Chloroquine (8 cases)	Control (8 cases)
Initially	36.1	27.1
At 3 months	23.2	52.9
Percentage change ..	-35.7	+95.2

Hence it is clear that the difference in composition is not such as to account for the better results among the chloroquine group.

The two series at six months were not strictly comparable, and all that can be said is that the results at this time show the continuing improvement of the chloroquine-treated cases.

SIDE-EFFECTS

These were unimportant, and, in spite of the fact that the average daily dosage employed was rather high (470 mg.), 17 of the 25 patients had no side-effects at all. In one case the drug had to be stopped on account of a rash affecting the front and back of the chest and abdomen and the arms. This quickly disappeared when the treatment was discontinued. Seven other patients

had minor toxic side-effects which only necessitated reduction in dosage and alteration in the time of taking the drug. Three patients had giddiness and three epigastric discomfort, and two complained of difficulty in focusing. Because of this tendency for chloroquine to produce "swimminess"—giddiness and difficulty in focusing—it was considered wise to give the tablets last thing at night. Leucotrichia is an interesting side-effect and was noticed in two patients who were not included in the trial series. The colour of the hair returned to normal when administration of the drug was stopped.

SUMMARY AND CONCLUSIONS

A controlled trial of the antimalarial drug chloroquine in the treatment of active rheumatoid arthritis appears to indicate that it is an effective anti-rheumatic remedy. Its action, though slower than that of the steroid group of drugs, is definite and relatively free from side-effects.

Further follow-up of the patients taking part in the trial showed continued improvement, but it appears that cases of rheumatoid arthritis vary greatly in their response to chloroquine.

The results obtained in this investigation suggest that the use of chloroquine in rheumatoid arthritis is worthy of further investigation.

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ORIGINAL PAPER

PERITENDINITIS CALCAREA AFFECTING THE HAND

CASE REPORT

By J. J. P. LOMAS

From the Middlesex Hospital, London

CALCIUM deposits are often seen in radiographs of the shoulder, and less commonly in other situations, such as around the hip-joint. Few cases of peritendinitis calcarea affecting the hand have been reported, and the following case history may therefore be of interest.

CASE HISTORY

Mrs. C. J., aged 40, a telephonist-clerk, developed an acutely tender, warm, red swelling in the palm of the right hand over the head of the second metacarpal bone. The right index and middle fingers became so stiff and painful that she could not hold a pencil to write, and she was unable to sleep at night owing to the severe pain in the hand. She stated that she had noticed a small painless lump at the base of the right index finger three years ago, whilst working as a barmaid; she had followed this occupation, which involved pulling up pints of beer with the right hand, for over six years.

On examination, she appeared to have an acute cellulitis of the hand, but radiographs showed a large amorphous mass of calcium in front of the second right metacarpo-phalangeal joint (Plate VII, Fig. 1). The erythrocyte sedimentation rate, white cell count, and serum uric acid level were within normal limits.

The right hand was immobilized on a padded palmar splint with immediate and dramatic relief of symptoms, and 48 hours later the acute inflammation had subsided and a small hard lump could be felt at the base of the right index finger, which was slightly tender. A week later the patient was able to use her hand normally and discarded the splint. Three months later the calcium deposit could not be seen in radiographs of the hand (Plate VII, Fig. 2), and six months later no lump could be palpated and the patient has remained symptom-free.

DISCUSSION

Sandström (1938) first suggested the name "peritendinitis calcarea" for this condition, but it has also been called periarthrits calcarea, bursitis calcarea, tendinitis calcificans, and calcifying bursitis. The hand is not frequently affected. Sandström (1938) reported involvement of the hand and wrist in only 2.4% of 329 cases, whilst King and Mahaffey (1953) described it in only 1.7% of 468 cases. Small numbers of cases have also been described by Carroll *et al.* (1955), Cooper (1942), DePalma (1947), Martin and Brogdon (1957), Seidenstein (1950), and Vasko (1946).

PLATE VII



FIG. 1.—Radiograph of right hand: oblique view showing calcified deposit in front of 2nd metacarpophalangeal joint.



FIG. 2.—Radiographs of right hand showing: left—calcium deposit superimposed on head of 2nd metacarpal bone; right—disappearance of calcium deposit four months later.

PLATE VIII



FIG. 1.—Patient wearing shoulder abduction splint.

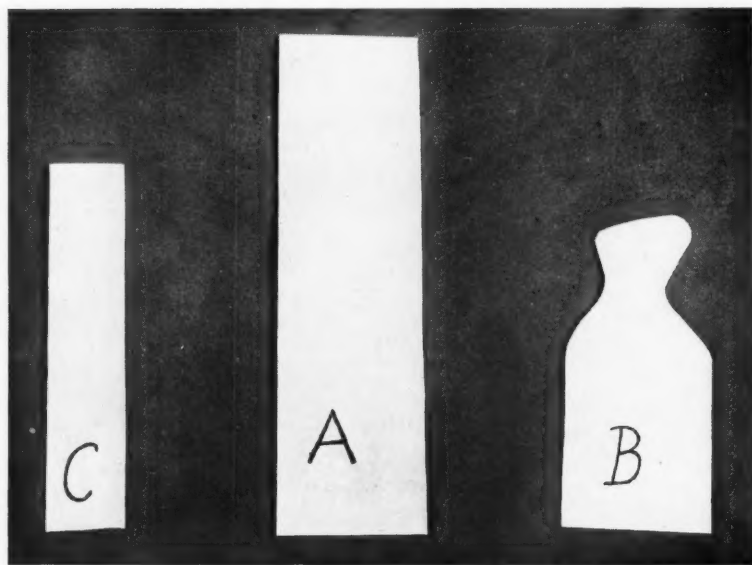


FIG. 2.—The three component pieces as described in the text.

[G.H.D., T.F.]

The cause of the condition is obscure, though most authors believe that local trauma resulting in a slight tear of tendon or ligament leads to local tissue necrosis and subsequent deposition of calcium, which is usually found within the tendon or its sheath, or in an adjacent soft-tissue sac, rather than within an actual bursa. The clinical picture may resemble that of acute cellulitis, tenosynovitis, arthritis, osteomyelitis, or gout, though Sandström (1938) has described chronic and latent forms as well which may be asymptomatic and discovered only by chance on radiography. Martin and Brogdon (1957) claim good results from radiotherapy, but hydrocortisone injections, or immobilization as in this case, may prove equally effective.

SUMMARY

Deposits of calcium in or around the tendons of the hand are uncommon, but may be associated with an acute inflammatory reaction which must be distinguished from cellulitis, bursitis, arthritis, or gout. They are probably similar to those which are found more commonly around the shoulder. Radiography establishes the diagnosis of acute peritendinitis calcarea. The condition appears to be self-limiting, but treatment by immobilization, local hydrocortisone injections, and radiotherapy rapidly relieves symptoms, with restoration of function.

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NEW APPLIANCES

SHOULDER ABDUCTION SPLINT

BY G. H. DOBNEY AND T. FAREWELL

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THE shoulder abduction splint illustrated in Plate VIII, Fig. 1, is composed of three pieces (see Fig. 2). Piece A is made of reinforced $\frac{1}{8}$ -inch polythene measuring approximately 28 by 8 inches and fits alongside the chest wall from the waist up to the axilla and along the arm to the elbow. Piece B, for the forearm and hand, is also of reinforced $\frac{1}{8}$ -inch polythene and measures approximately 17 by 8 inches, narrowing to $3\frac{1}{2}$ inches at the wrist. This is riveted to piece A at an angle of 60 degrees. Piece C is of treble thickness $\frac{1}{8}$ -inch polythene approximately 20 by 4 inches, which serves as a supporting buttress for pieces A and B, to which it is riveted at both ends. This is found in practice to give a stronger support than a single thickness of $\frac{3}{8}$ -inch polythene and may be slightly guttered to give greater rigidity. There are three straps $1\frac{1}{2}$ to 2 inches wide to go around the body, and a shoulder strap 2 inches wide padded with $1\frac{1}{2}$ -inch Moltopren which goes over the opposite shoulder. The whole splint is padded with $\frac{1}{2}$ -inch Moltopren, which is heat-welded to the polythene.

This splint affords a light and easily removable support, and drags less than the heavier one made of plaster. The side-piece is wide to avoid any tendency to anterior-posterior movement, and because of this no separate pieces around the body are needed to keep it in position. As will be seen from the illustration, it is robust enough to support the arm of a heavy man.

ACKNOWLEDGMENTS

Our thanks are due to Mrs. E. I. Benady, M.C.S.P., who made the splints, and to Miss E. Mason, of the photographic department, St. James' Hospital, Balham, for the illustrations.

REVISION SERIES

CURRENT TRENDS IN THE MANAGEMENT OF RHEUMATOID ARTHRITIS

By BARBARA M. ANSELL

As the cause of rheumatoid arthritis is unknown, effective clinical management is based on a knowledge of the course of the disease and factors which influence this. Studies of the course of this disorder, however, are few, and in interpreting what there are it is important to remember that there are wide differences of opinion as to what constitutes rheumatoid arthritis, as well as in the choice of criteria for measuring the progress of the disorder. Short and Bauer (1948) in a twenty-year follow-up found improvement in almost 70% of patients treated conservatively. Other long-term studies have shown similar results (Duthie *et al.*, 1957; Bywaters and Dresner, 1952). Hospital series, and particularly those from rheumatological centres, probably bear little relationship to the over-all incidence of this disease (Kellgren and Lawrence, 1956), but as a yardstick in the management of patients they are extremely valuable. To date there is no known symptomatic or suppressive treatment which has been clearly shown to alter the long-term course of rheumatoid arthritis, so that treatment is planned to help the patient during the more active phase of the disease.

PRELIMINARY ASSESSMENT

The management of a patient begins as soon as the diagnosis of rheumatoid arthritis is made or a known case of rheumatoid arthritis is referred for further care. Even at this first interview it is important to explain to the patient the various problems that his disease has given rise to, emphasizing the long-term nature of the disorder with its tendency to improvement, and the various measures that are available to help him.

Because of the variation in the severity of the disease process in different individuals, as well as in the stage at which patients are referred, before starting treatment a full assessment is required, and this is usually easier if the patient is admitted to hospital. Assessment should include a detailed history and full clinical examination, as well as an adequate survey of joint involvement and muscle state, so that other diseases which may modify management or the presence of complications which will alter the prognosis are not overlooked. The complications to be excluded particularly include secondary amyloidosis, arterial involvement, polyneuritis, cervical involvement with cord or root

compression, and, on occasion, complications resulting from therapy given previously, such as peptic ulcer. In order to determine how much rehabilitation is possible the extent of joint involvement, together with the position, range of movement, stability, and secondary degenerative changes of involved joints, has to be reviewed, and for this adequate radiology is essential. Clinical impressions of the state of activity of the disease and degree of anaemia must be confirmed by laboratory examinations.

Once this information is available it is possible to decide how much improvement can be expected and what lines of treatment are required to produce it. The whole team of medical and nursing staff, physiotherapists, and occupational therapists should co-operate when discussing the problems and possible lines of therapy, while the social services will frequently be required to enable these measures to be put into practice. It is important at this stage to explain fully to the patient the various decisions that have been taken, and before treatment is started to fix certain objectives to be worked for.

MANAGEMENT OF THE ACUTE STAGE

The onset of rheumatoid arthritis may be acute with constitutional disturbances, and for these patients confinement to bed is desirable. However, the patient is still seen who has been looked after at home during the acute phase of the illness, with kindly relatives putting pillows beneath his head and knees and tightly covering his feet with bed-clothes, so that by the time the disease has become less active and he tries to resume his normal life he is unable to dress because of fixed shoulders and wrists and cannot stand or walk because of flexion contractures of the knees and bilateral foot-drop, frequently with eversion deformity. Thus, when a patient is in bed, however ill he may be, the wrist-joints should be kept in a position of dorsiflexion and the knees in full extension by means of light-weight plaster splints, the feet protected from tight bed-clothes by a cradle, and the shoulders put through a complete range of movements each day; in addition daily exercises should be performed to prevent general muscle wasting.

Unless these facilities are available, the physician who puts a patient to bed takes on a grave responsibility. At the beginning the patient will need individual attention from the physiotherapist to learn the exercises and to be given the necessary support for their performance. As soon as possible active exercises in bed in ward classes conducted by the physiotherapist are excellent. Here particular attention is paid to the maintenance and improvement of shoulder and hip movement and the quadriceps muscles, as well as a full active range of movement of all joints. Whenever possible classes should be held twice each day,

and, to begin with, splints should only be removed for these classes. In cases with hip involvement prone lying, starting with five minutes daily and working up to half an hour twice daily, is of great value. Once improvement is satisfactorily under way the plaster splints may be removed for longer periods each day, and at this stage the occupational therapist can assist by providing suitable occupation to encourage movement and strengthen the muscles.

When a satisfactory general condition has been achieved, hydrotherapy is of particular value. Movements are possible in warm water which are difficult on dry land, so that the general range and strength of movement can be increased and, while still not weight-bearing, the patient can be retrained in walking. From here the rate of progress to weight-bearing will depend on the severity of the disease process, together with the extent of involvement of the hips, knees, ankles, and feet. Particularly for patients who have not walked for a long while, and for young children, a walking chair is helpful in enabling them to regain their balance. If the knees remain persistently painful, or the quadriceps muscles are still weak, or large effusions persist, hinged walking plasters should be used when commencing weight-bearing, and these should be gradually discarded over the next few months.

To summarize, in the active phase of the disease an intensive physiotherapeutic regimen is required, aiming at the maintenance of muscle power by active exercises, the conservation of good posture, and co-ordination of the joints, together with the preservation of as much joint movement as possible. Heat may be of value in allowing the patient to move a limb a little more readily, but has little other therapeutic value.

STAGE OF CONTINUED ACTIVITY

For patients referred at a later stage of the disease the programme described above can usually be modified to fit their particular needs. Most patients with active disease benefit from a short period of bed rest coupled with active physiotherapy in bed, while particular problems such as flexed knees and localized muscle weakness may require special attention. If flexion contracture of the knees is present, serial splinting under adequate analgesia using complete plaster cylinders changed weekly over a three- to four-week period may be of great benefit. This should be followed by the application of hinged splints for weight-bearing. In patients with severe lateral instability or early subluxation of the knees weight-bearing should only be resumed with adequate hinged splints. The wrists may also require serial splinting to improve their position. Both for knees and wrists occasionally a complete plaster cylinder is required to help bony ankylosis where the joint is painful and has undergone severe

destruction. The main principles of physiotherapy outlined in the previous section apply here also, but this stage is usually one of improvement with particular concentration on local problems rather than maintenance of muscle power by active exercises.

DRUG THERAPY

Salicylate is the most valuable single agent for the relief of pain and muscle stiffness in rheumatoid arthritis. Various preparations such as Disprin, aspirin, enteric-coated sodium salicylate, and Paynocol are available, and from these it is usually possible to select a suitable one for most patients. It is advisable to avoid codein. co. whenever possible because of its phenacetin content, which, when the drug is given over prolonged periods, may cause methaemoglobin-aemia and haemolytic anaemia. Adequate dosage must be given, and from a practical point of view this usually means a dose just short of one which will cause the earliest toxic symptom—namely, tinnitus. Although a great deal has been heard recently of bleeding as a result of salicylate therapy, from a practical point of view it is only in the occasional case that this reaches proportions which might lead to anaemia.

For the management of many cases physiotherapy combined with salicylates is sufficient, but in other cases, either because of an intolerance to salicylates in the dosage necessary to control symptoms or because of the degree of activity of the disease, further therapy may be required. Phenylbutazone is often of great value and is probably best given in doses of 100 mg. two or three times daily. As its effect is cumulative and in the early days after its introduction large doses were employed, this drug gained a bad reputation as regards toxicity. Although it is important to watch for the development of a rash, which is frequently the first sign of toxicity, and to be on guard against granulocytopenia and peptic ulceration, at the dosage suggested there is very little risk (Kuzell *et al.*, 1955).

Chloroquine phosphate in a dosage of 250 to 500 mg. daily is said to be of value in some 70% of cases (Freedman, 1956). This too is not without side-effects, including dyspepsia, sore mouth, and leucopenia. Gold given intramuscularly in fairly high dosage may be of benefit, and this appears to apply particularly to severely ill patients (Freyberg, 1950). With this treatment also side-effects such as rash, dermatitis, albuminuria, jaundice, and blood dyscrasias must be watched for.

STEROID THERAPY

Steroid therapy, in the form either of injections of corticotrophin or the oral administration of cortisone, hydrocortisone, prednisone, triamcinolone, or dexamethasone, will undoubtedly lead to improvement in a large number of

cases. However, serious complications may accompany the use of one of these preparations, and before starting therapy it is important to decide whether an adequate conservative regimen has really failed and the severity of the disease process warrants the risk entailed. From a practical point of view, the indications for steroid therapy would appear to be overwhelming disease, visceral complications, and other rare complications such as haemolytic anaemia, arteritis, etc. It may be valuable particularly as a short-term measure in aiding rehabilitation, and the newer steroids such as prednisone and prednisolone do seem to help control extreme nodule formation.

The hazards of therapy must be fully appreciated by the patient, so that he may take all reasonable care to prevent them. In view of the danger of adrenal suppression during steroid therapy and for some months afterwards it is very important that the patient should be aware of the nature of the treatment, and preferably carry a card stating the drug given, so that if emergency treatment, either medical or surgical, at a hospital where he is unknown is ever required the appropriate measures may be taken. Ulceration of the stomach and of the duodenum probably occurs more frequently in patients treated with steroids, but, even if the total incidence is not greater, the problems that may arise in such cases—namely, silent perforations and recurrent haematemeses—are certainly more troublesome. It has not yet been shown whether the risk of these can be minimized by concurrent administration of Aludrox, but it would seem a wise precaution to advise a patient not to take any form of medication, either salicylate or steroid, on an empty stomach. There is an increased susceptibility to infection during steroid therapy, and, because of the ability of steroids to mask physical signs, serious disease such as pneumonia, or peritonitis due to perforation of an acute appendicitis or salpingitis, may not be suspected until too late for remedial measures to be instituted. Any apparent increase in requirement of steroid or the development of symptoms, however mild, is suggestive of an infection, and should lead to a careful reassessment of the case.

Crush fracture of the vertebrae and fracture of a long bone after minor trauma may also complicate steroid therapy. As many of the patients who need steroid therapy are osteoporotic—and this is particularly the case with post-menopausal women—the advisability of giving “covering” treatment with anabolic steroids has been suggested. It is not yet certain, however, whether this is of practical value, but it would seem a rational procedure. Children maintained on steroid therapy fail to grow in height, and this appears to be related primarily to the treatment itself, as if this is stopped, even when the disease is active, linear growth is resumed, although at a slower rate than normal.

Though in Great Britain it is rare for a severe Cushingoid state to be induced by steroid treatment, purpura due to early prednisone poisoning is not so

uncommon, and should be regarded as an indication for a reduction in dosage. Occasionally diabetes may develop, but is usually only transient.

The choice of steroid to be employed in any given case is debatable, and is probably best determined by the physician in charge on the basis of his particular knowledge. It would seem desirable to use a non-sodium-retaining preparation, such as prednisone or prednisolone, but the advantages of some of the newer steroids have yet to be established. The muscle weakness which occasionally develops during triamcinolone therapy may become a further problem in the patient already severely disabled. Contraindications to steroid therapy include active tuberculosis, active peptic ulceration, marked renal insufficiency, psychosis and severe psychoneurosis, and severe diabetes.

In addition to systemic steroid therapy, local steroid injection may be of value when only one joint is affected, when one joint responds more slowly than the rest, or when an acute flare appears in a single joint possibly associated with trauma. The regular intra-articular administration of steroids as maintenance therapy would not, however, appear to be a practical proposition.

OTHER MEASURES

Some form of adjuvant treatment may be required in certain cases—for example, iron given either intravenously or intramuscularly may be necessary for severe anaemia, while anabolic steroids such as testosterone or Nilevar may be of value in rebuilding wasted patients once there is a waning of the disease activity.

There seems to be no indication that infective foci (Davidson *et al.*, 1949) play any part in rheumatoid arthritis, so that in the absence of a specific indication teeth, tonsils, etc., should not be removed.

Local radiotherapy to joints has no effect.

STAGE OF ESTABLISHED DEFORMITIES

In considering rehabilitation of the seriously crippled patient the psychological attitude as well as the state of the deformed joints must be taken into account. Too frequently a passive, dependent state has been established, and, although patients are ready to accept a miracle whereby their joints are restored to normal, they are not anxious to aid themselves in rebuilding their lives. Thus, although our orthopaedic colleagues can do a great deal for the handicapped patient, the programme of treatment requires more care in planning than is necessary for the early acute case. Simple measures such as serial application of plasters for flexion deformities have already been mentioned. If this is not successful, manipulation of the knees may be required. Other joints—hips,

wrists, and feet—may also benefit from manipulation. Arthrodesis of a painful, unstable knee can enable a patient to resume fairly normal activities, while for the patient with a persistent knee effusion but little severe damage to the joint synovectomy may be of great value. Again, arthroplasty or arthrodesis of a disorganized hip-joint may aid remobilization. Procedures by which hand function may be restored or improved include suturing of a ruptured tendon in a finger and the fixation of an unstable terminal phalanx.

Once mechanical restoration has been accomplished, adequate physiotherapy is necessary to improve muscle strength, aided by occupational therapy aimed at retraining the muscles. At this stage also the question arises as to the possibility of changing the patient's job and, in the case of young patients, the advisability of training or retraining for a more suitable occupation. For the more severely handicapped patient the occupational therapist can help enormously by supplying him with such self-help devices as he needs and training him in their use so that he may achieve the maximum degree of independence.

AFTER-CARE

It is advisable to see patients fairly soon after their discharge from hospital to make sure that various arrangements instituted during the in-patient period are proceeding satisfactorily. In the early stages the patient should attend for physiotherapy at regular intervals, when a check can be made that he is performing the prescribed exercises correctly; this also provides the opportunity to remind patients of the need to continue their daily exercises. It is also important to ensure that the supply of requisite drugs is maintained satisfactorily, either through the patient's own doctor or from the out-patient dispensary. Another point to be considered is whether the appliances necessary for daily living—such as a high chair, raised toilet seat, a stool or support for bathing—have been introduced. For the severely crippled housewife adaptation of the kitchen may be necessary (Cooksey, 1952), while the less severely afflicted patient can frequently be helped by suggestions from the occupational therapist in solving the problems that he encounters. For those patients who have been able to resume work a reassuring chat about their problems is often of great value.

SUMMARY

In the management of rheumatoid arthritis every patient requires individual assessment as to the disease activity, the severity of joint damage, extent of deformities, and presence of complications. On the basis of this assessment a programme of treatment can be outlined to improve the functional state so that he or she can live a reasonable existence despite the disease.

Such a programme will consist of intensive physiotherapy aimed at improving muscle power by active exercises, splintage to maintain and improve joint position, and preservation of as much joint movement as possible, together with adequate drug therapy to control pain and stiffness, followed by rehabilitation to as near normal life as possible through the services of the occupational therapy and social service departments.

In order to enable these measures to be carried out the patient should be admitted to hospital, where it is important for the problems of the disease to be explained and a satisfactory relationship between the patient and the team of workers looking after him established.

Adequate provision for the after-care and follow-up of these patients once they are discharged from hospital is essential.

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THE SIXTEENTH ANNUAL MEETING

THE sixteenth Annual Meeting of the British Association of Physical Medicine was held at Guy's Hospital, London, on April 17 and 18, 1959, with the retiring President, Dr. P. Bauwens, in the chair. About 80 members were present.

SCIENTIFIC PROGRAMME

On the morning of Friday, April 17, there was a symposium on the "Graphical Representation of Movement", and in the afternoon a discussion on "The Spine". The Annual General Meeting on Saturday, April 18, was followed by a demonstration of current research in the Department of Physical Medicine illustrated by apparatus, film loops, photographs, and diagrams. In the afternoon short papers were read by members and guests.

April 17—Morning. Symposium on Graphical Representation of Movement

DR. J. JOSEPH: *"The Electromyography of Postural Muscles—Leg and Thigh"*

Dr. Joseph defined the "stand-at-ease" position and described the findings on electromyography with subjects standing in this position. Surface electrodes were used and special attention was paid to adequate amplification. Electrical activity was only detected in the calf muscles, none being detected in the thigh muscles, including the quadriceps. The muscles of the vertebral column had not yet been fully investigated, but it seemed that the back muscles could not be treated as one unit and there was often asymmetry in muscle action. Dr. Joseph suggested that the stand-at-ease position was maintained by the calf muscles, the posterior ligaments of the knee, and the anterior ligaments at the hip. If the subject flexed or extended the trunk, electrical activity could be demonstrated in the hamstrings and the glutei. Dr. Joseph illustrated these findings by slides and by a cinematograph film which showed simultaneous pictures of the subject moving and of the oscilloscope screen. He could find no evidence to support the popular concept of postural tone.

DR. A. NIGHTINGALE: *"The Relationship between Muscle Force and the Electromyogram"*

Dr. Nightingale described a method of measuring tension in the calf muscles, and showed that an increase in tension could be related to the amplitude of motor unit potentials recorded by electromyography.

DR. T. H. HILLS: *"Analysis of Cervical Spinal Movement" (film)*

Dr. Hills introduced this film on cineradiography of the cervical spine by describing the method used. It was possible to avoid exposing the patient to excessive radiation by the use of an image intensifier. The film illustrated the marked degree of sliding movement occurring at the posterior intervertebral joints on normal flexion and extension of the spine. There was considerable limitation of this movement at the site of disk degeneration. Movement of the cervical spine was restricted even by the wearing of a felt collar, while a rigid brace allowed only slight movement to occur at the upper joints.

MR. C. ENGEL and DR. P. HUME KENDALL: "Sequential Still Photography"

Mr. C. Engel described the technique and advantages of sequential still photography in the study of movement. Still photographs could be analysed in detail, and rapid shutter action allowed several pictures to be taken each second with good definition. Dr. Hume Kendall discussed the application of this technique to the study of spinal movement and its possible use in assessing the value of different treatments.

April 17—Afternoon. Discussion on "The Spine"

The opening speakers in this discussion were Dr. J. M. TANNER, Professor R. J. LAST, Dr. A. D. THOMSON, and Dr. E. J. CRISP.

Dr. J. M. Tanner described the difference in rate of growth of various parts of the body, especially the trunk and limbs, and the growth spurt which occurred at adolescence and was due mainly to growth of the vertebral bodies at the epiphysial plates. Studies of inbred rabbits suggested that the size and shape of the various vertebrae were determined genetically.

Professor R. J. Last gave an excellent account of the anatomy of the spine, relating structure to function where this was possible. Whilst the function of the ligamenta flava and supraspinous ligaments was obvious, he could not account for the purpose of the anterior and posterior longitudinal spinal ligaments, or for their curious attachment to the vertebral bodies. He described the anatomy of the intervertebral disk in some detail, and drew attention to the fact that it was a strong ligament binding the vertebrae together, its fibres continuous with those of the epiphysial plate. The obliquely directed fibres of the annulus fibrosus, travelling in opposite directions in adjacent lamellae, prevented excessive movement in any direction. The strength of these fibres was demonstrated by the fact that they were often intact after severe spinal injuries which had fractured the vertebral bodies. The nucleus pulposus was a gel-like material, and when it was compressed exerted a considerable centrifugal force on the fibres of the annulus. These fibres were therefore stretched, not compressed, on weight-bearing. Prolapse of the nucleus might be related to overhydration of the nucleus or to changes, possibly degenerative, in the annulus fibrosus. Professor Last drew attention to the hyaline cartilage of the epiphysial plate, which persisted in man but not in animals, ossification occurring only at the periphery. This cartilage rested on trabeculae of cancellous bone and marrow, not, as elsewhere, on thickened subchondral bone.

Dr. A. D. Thomson described the pathology of degenerative disease of the spine, illustrating his talk with photographs of pathological specimens, photomicrographs, and actual microscopical sections. The synovial joints of the spine, including posterior intervertebral, costo-vertebral, and possible neurocentral joints, were subject to the same degenerative changes as those which affected synovial joints elsewhere, with fibrillation of cartilage, eburnation of bone, and osteophyte formation. These osteophytes could project into and deform intervertebral foramina. Dr. Thomson discussed the normal appearance of the intervertebral disk, and the degenerative changes affecting both nucleus pulposus and annulus. Vertical prolapse of the nucleus through the cartilaginous plate resulted in Schmorl's nodes, whilst bulging of the annulus anteriorly or posteriorly resulted in elevation of the periosteum and osteophyte production, or osteophytosis.

Dr. E. J. Crisp discussed clinical aspects of intervertebral disk lesions and of lesions affecting the posterior intervertebral and costo-vertebral joints. He suggested that some acute, short-lived episodes of acute back pain, brought on by bending and relieved by manipulation, might be due to nipping of synovial fringes in these joints. Dr. Crisp also put forward his views on the possible ways in which traction might influence disk lesions. He distinguished between the acute and chronic phase of disk lesions, and recommended rest in bed or plaster for the acute symptoms rather than manipulation.

In the discussion that followed, Professor Last said that there were nerve fibres in the disk, but these were probably vasomotor; he was not convinced that the neuro-central joints were a definite structure, like other synovial joints. The cervical spinal cord had a very curious blood supply, being dependent on the anterior spinal artery to the level of T1; any lesion affecting the spinal artery about T1 might produce ischaemia of this segment of the cord. This could account for wasting of the small muscles of the hand in a mid-cervical lesion.

April 18—Afternoon. Short Papers

DR. R. HARRIS: "*Accidents in a Department of Physical Medicine*"

Dr. Harris noted that accidents could occur in departments which were badly lit, poorly sited, incorrectly equipped, and understaffed. Even when such factors had been eliminated, accidents could still occur. He had kept a record of accidents occurring to staff and patients in one hospital dealing with severely disabled patients. During some 800,000 treatments given over a period of four years 43 accidents were reported, 38 involving patients. There were only five burns, mostly minor, of which only two could be ascribed to faulty technique. Falls from plinths, stools, and wheel-chairs with faulty brakes were common causes of injury, usually slight, though fractures did sometimes occur, especially in patients with fragile bones. Some physiotherapists appeared to be more accident-prone than others. Accidents could be prevented by lowering plinths and overhead suspension apparatus, replacing stools with an overlapping edge, by making floors non-slip, and by the regular overhaul of wheel-chairs every three months, preferably by the hospital engineer.

DR. G. HOLDEN and DR. P. HUME KENDALL: "*Intra-articular Prednisolone Therapy*"

Dr. G. Holden described the results of a trial comparing the effects of intra-articular injection of 25 mg. of prednisolone acetate with those using 100 mg. of prednisolone trimethyl acetate in a small number of patients with rheumatoid arthritis. Joint tenderness was assessed by means of a numerical scale (0-3), and the change in the range of joint movement at each examination was expressed as the percentage of maximum possible change (P.P.C.). Dr. Holden concluded that the maximal improvement followed the first injection of prednisolone, and subsequent injections were of little value if given at short intervals. If single injections were given, 100 mg. prednisolone appeared to be more effective than 25 mg., though there was sometimes a temporary increase in joint pain.

Dr. M. Thompson agreed that repeated short-interval injections of steroids were valueless, and pointed out that results could be misleading if one agent was injected

shortly after another. He had not found doses higher than 37.5 mg. prednisolone more effective. He noted the fact that small joints seemed to respond better to prednisolone than to hydrocortisone.

DR. G. D. KERSLEY: "*The Value and Dangers of Treatment of Rheumatoid Arthritis with Certain Antimalarial Drugs*"

Dr. Kersley discussed the results of treating 36 patients suffering from rheumatoid arthritis with alternating courses of Plaquenil, Camoquine, and control tablets. The initial dose of Plaquenil was 400 mg. daily, and this was later doubled. The daily initial dose of Camoquine was 400 mg., and this was later halved. Temporary benefit was noted by most patients, though it was usually delayed for a few weeks after starting treatment. Mild side-effects were frequent, and often noted by the patient when he stopped taking the drug. The best results were obtained with Plaquenil 800 mg. daily, though most patients had a relapse when the drug was stopped. Examination of the cornea with a slit-lamp revealed corneal opacities in nearly half the patients, but they were most frequently found when the patient was taking Camoquine, and in all cases they disappeared within six months of stopping administration of the drug. One death due to agranulocytosis occurred with Camoquine 400 mg. daily, but this might have been avoided had the patient been admitted to hospital earlier.

During the discussion which followed, Dr. I. Williams referred to a series of 50 patients under treatment at Cardiff with 1,800 mg. Plaquenil daily; one patient had developed a scotoma and become almost blind in one eye. Dr. B. Freedman said that he had treated over 200 patients with various antimalarial drugs during the past eight years, and had recently seen a scotoma develop in three patients whilst taking 800 mg. Plaquenil daily. He had not observed any patient develop a blood dyscrasia whilst taking antimalarial drugs. Dr. D. R. L. Newton reported the occasional occurrence of itching of the hands and feet in patients taking these drugs, and change in the colour of the patient's hair had also been noted.

MR. I. J. MCQUEEN: "*The Development of Thigh Muscles after Knee Operation*"

Mr. McQueen prefaced his remarks on the after-care of patients who have undergone knee operations by illustrating the type of case dealt with at operation by general debridement. In order to obtain adequate exposure of the joint the patellar ligament was divided and the patella retracted. After operation a compression bandage was applied for six weeks, and no flexion was permitted until this was removed. Static quadriceps exercises and straight leg raising were started immediately after operation, and after two weeks these were performed against resistance. Mr. McQueen emphasized the importance of developing the hamstrings as well as the quadriceps muscle, and demonstrated the use of a hinged quadrant specially designed for weight-resisted exercises to allow variations in the angle at which maximal resistance was applied. This was more comfortable for the patient than the iron boot, and could be used to strengthen hamstrings as well as the quadriceps. Mr. McQueen thought that weight-bearing exercises such as full-knees-bend were important, and even in the older patient, and in those with rheumatoid arthritis, squatting could be carried out with the aid of chairs of various heights.

DR. J. B. MORRISON: "*The Electromyographic Changes of Adynamia Episodica Hereditaria (Hyperkalaemic Familial Periodic Paralysis)*"

Dr. Morrison described the electromyographic findings in five patients with this rare disease. The condition is recognized by the spontaneous hyperkalaemia which occurs during attacks of paralysis of skeletal muscles. Affected subjects are sensitive to small amounts of potassium given by mouth; adrenocortical and renal functions are apparently normal. Abnormal electromyographic changes are observed during an attack only when fibrillation, myotonic runs, high-frequency myopathic patterns, complex polyphasic units, and reduced interference pattern on attempted volition are found.

DR. J. G. PARISH: "*The Effects of Delay in the Rehabilitation of Fractures of the Tibia and Fibula*"

A previous survey of 555 patients treated at an R.A.F. rehabilitation unit emphasized the importance of intensive treatment after the removal of plaster casts, and the delay in recovery when patients were not referred at once for active rehabilitation. Dr. Parish had therefore studied the results of treatment of 26 miners admitted to a civilian rehabilitation centre between July, 1957, and March, 1959. Delay in treatment after removal of plaster resulted in patients requiring treatment for much longer periods at the centre. He suggested that intensive in-patient rehabilitation during the first few weeks after removal of plaster was valuable in correcting faulty walking patterns, controlling oedema, preventing ankle stiffness, and developing the power of the calf muscles.

MR. NIGEL PORTER: "*Abnormal Electromyographic Changes in the Anal Sphincter*"

Mr. Nigel Porter described the results of electromyography of the anal sphincter in health and in cases of rectal prolapse.

DR. ALAN STODDART: "*Tennis Elbow*"

Dr. Stoddart discussed the results of manipulation in some cases of tennis elbow and demonstrated the method he used for this.

At the conclusion of the Annual Meeting the President expressed the thanks of members of the Association to Dr. E. J. Crisp and his colleagues for the excellent programme which had been arranged and for the hospitality which they had enjoyed.

ANNUAL DINNER

The Annual Dinner of the Association was held at Stationers' Hall, Ludgate Hill, on April 17, by kind permission of the Warden of the Stationers and Newspaper Makers Company. Distinguished guests included the President of the Royal College of Physicians, the President of the Royal College of Obstetricians and Gynaecologists, Sir Cecil Wakeley, Professor Kellgren, and Dr. G. Godber from the Ministry of Health. The health of the Association was proposed by Professor A. M. Claye, President of the Royal College of Obstetricians and Gynaecologists, and Dr. P. Bauwens replied on behalf of the Association. Dr. W. S. Tegner proposed the health of the Guests, and Dr. G. Godber replied for them. After dinner the Warden gave a

brief history of his Company and of its Hall, which had been badly damaged in two world wars.

ANNUAL GENERAL MEETING

The sixteenth Annual General Meeting of the British Association of Physical Medicine was held at Guy's Hospital on April 18, 1959, at 10.30 a.m. The Retiring President, Dr. P. Bauwens, was in the chair, and approximately 80 members were present.

The minutes of the 1958 Annual General Meeting and the report of Council for 1958-9 were approved. The report of the Honorary Treasurer together with the balance sheet to December 31, 1958, were received and were approved.

The Honorary Editor, Dr. A. C. Boyle, announced with regret the resignation of Dr. D. R. L. Newton, the Assistant Editor, as he was leaving London to take up an appointment in the North of England, and welcomed Dr. S. Mattingly as his successor. He paid tribute to the work done by Dr. Newton, Dr. D. C. Arnott, and Mr. H. C. Papadopulo.

Dr. H. A. Burt was then elected President of the Association in succession to Dr. P. Bauwens. He was invested by the Retiring President at the end of the Annual General Meeting. Dr. Bauwens thanked the Officers of the Association and Members of Council for their co-operation and help during the three years he had held office, and he also paid tribute to Miss M. Morris for her invaluable assistance in organizing the affairs of the Association during the past year.

Other officers elected for 1959-60 were:

Vice-President: Dr. W. S. Tegner.

Honorary Treasurer: Dr. J. Shulman.

Honorary Secretary: Dr. A. T. Richardson.

Honorary Editor: Dr. A. C. Boyle.

The following members were elected to fill vacancies on the Council: Dr. D. A. Brewerton, Dr. T. K. Davidson, Dr. W. Russell Grant, Dr. R. M. Mason, and Dr. Donald Wilson.

THE NORTH AND MIDLANDS PHYSICAL MEDICINE CLUB

THE fifth meeting of the North and Midlands Physical Medicine Club was held at Durham on Saturday, March 21, 1959. Dr. J. N. Walton opened the morning session with an entertaining paper on "A Neurologist Looks at Physical Medicine", which led to a vigorous discussion on the treatment of the carpal tunnel syndrome. Dr. M. Thompson followed with a very thorough survey of local steroid therapy. In the afternoon Dr. J. G. Parish showed cases of the following hereditary disorders of connective tissue: (1) Marfan's syndrome; (2) Achard's syndrome with polyarthritis of rheumatoid type; (3) arachnodactyly with congenital lesions of lungs and kidney; and (4) osteo-onychodysplasia.

Eighteen members and their guests attended the cocktail party and dinner in the evening. It is hoped to hold the next meeting at Leicester in the spring of 1960.

ABSTRACTS OF THE LITERATURE

Peptic Ulcers in Rheumatoid Patients Receiving Corticosteroid Therapy. R. H. FREIBERGER, W. H. KAMMERER, and A. L. RIVELIS. *Radiology*, 1958, 71, 542.

Over a period of twelve months 114 patients with rheumatoid arthritis who had received corticosteroid therapy for six months or more were studied for the occurrence of peptic ulcer.

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Ulcers were found to have developed in 6 of 22 men and in 29 of 95 women—a relatively equal incidence for the sexes, which is in sharp contrast to the far greater frequency of spontaneous peptic ulcers in males. Only 1 of 21 patients on a small dose of prednisone (2.5 to 7.5 mg. a day) developed an ulcer; of 58 patients given a moderate dose (10 to 15 mg. a day) 26 had an ulcer; only 5 patients received more than 15 mg. per day, and 2 of these developed an ulcer.

The location of the ulcers was unusual: only 5 of 35 ulcers were in the duodenum; the ulcers were typically large and shallow. In this series no carcinoma of the stomach was encountered.

Treatment is discussed briefly; in some instances corticosteroid therapy was continued despite the presence of an ulcer.

MAURICE F. HART

A Comparative Radiological Study of Reiter's Disease, Rheumatoid Arthritis and Ankylosing Spondylitis. R. M. MASON, R. S. MURRAY, J. K. OATES, and A. C. YOUNG. *J. Bone Jt Surg.*, 1959, 41B, 137.

A comparative examination was made of the radiological appearances in 25 cases of Reiter's disease, 81 cases of rheumatoid arthritis, and 38 of ankylosing spondylitis. Particular study was made of sacro-iliitis, calcaneal-spur formation, and peripheral arthropathy. No absolute means of differentiating the three conditions radiologically were found, but it appears that florid periostitis is suggestive of Reiter's disease. Large, rough calcaneal spurs with fluffy periosteal bone on the plantar surface are probably pathognomonic, although simple spurting and erosion were present in all three conditions. Sacro-iliitis was a common finding in Reiter's disease, although there was no qualitative difference in the early changes in the three conditions; advanced changes were not seen in rheumatoid arthritis.

Other radiological appearances showed some differences in quality and distribution, but without enough distinction to be of important diagnostic significance when considered in isolation.

P. J. R. NICHOLS

Gout in the Negro Female. G. P. RODNAN and M. W. GOLOMB. *Amer. J. med. Sci.*, 1958, 236, 269.

Until now the occurrence of gout in negro females has been considered a rarity. This paper reports the clinical and pathological findings in six such cases. The criteria for diagnosis are discussed. Renal disease of varying degree was found in all six cases.

The authors conclude that gout is not as rare in negro females as has been thought. It is suggested that allowances must be made for the sample of population which is examined before the racial incidence of a given disease can be estimated.

G. O. STOREY

Thyrototoxic Myopathy and Polymyositis in Elderly Patients. H. BOS-ROM and R. HED. *Acta med. scand.*, 1958, 162, 225.

Of four patients with severe myopathy, in two the condition was classified as thyrototoxic and in two as polymyositis. The clinical pictures were very similar in the two groups and initially the changes were misinterpreted as due to age. The differentiation of the cases is discussed, with the biochemical, electromyographical, and histological findings.

G. O. STOREY

The Aetiology of Hyperostosis Cranii (Metabolic Craniopathy). J. E. CAUGHEY. *J. Bone Jt Surg.*, 1958, 40B, 701.

This is a detailed clinical study of hyperostosis cranii from Otago Medical School. The author draws attention to the finding that hyperostosis cranii is one of the variable features of dystrophia myotonica, a disease with an equal incidence in males and females. Hyperostosis cranii also occurs in Morgagni's syndrome, with acromegaly, and in senile osteoporosis.

From detailed clinical studies, particularly in cases of dystrophia myotonica, the author suggests that in this condition, as well as in acromegaly and Morgagni's syndrome, the hyperostosis cranii is an expression of unrestrained activity of growth hormone.

Nine case histories (from six families) and 62 references are given.

P. J. R. NICHOLS

Prognosis in Traction Lesions of the Brachial Plexus. G. BONNEY. *J. Bone Jt Surg.*, 1959, 41B, 4.

This paper describes a ten-year study of 29 patients with complete supraclavicular traction lesions of the brachial plexus. The results of clinical examination, operative explorations, biopsies, and studies of axon reflexes are analysed and related to the progress of the lesions.

The prognosis of a lesion of the brachial plexus is determined by the severity of the injury (though not necessarily indicated by associated injuries) and the site of the damage. Even considering the generally poor prognosis for traction lesions of nerves, such injuries of the brachial plexus seem extraordinarily bad. The two chief factors responsible for the generally poor prognosis are the tearing apart of nerves distal to the intervertebral foramina and the avulsion of roots from the spinal cord. Clinical studies are of very little help in assessing prognosis. Operative exploration is only of value if a good exposure is obtained, and even then prognosis of lesions in continuity cannot be determined by inspection.

Axon reflexes were examined by responses to pricking through a drop of a 1% solution of histamine on the ulnar and radial side of the forearm, and by the vasomotor response of the fingers to cold water with heat-flow disks. Little difficulty was experienced in measuring the response to histamine; positive reactions were those with local vasodilatation and the formation of a "flare", and negative response was one of local vasodilatation and whealing. In general, results with cold vasodilatation tests were also clear-cut; if the vasodilatation was less than half that shown by the corresponding healthy fingers the response was classed as negative, if more than half it was classed as positive. Positive axon responses infer a preganglionic lesion and thus argue a grave prognosis. Negative axon responses signify a postganglionic lesion, but they give no indication of the severity of the lesion, beyond the point that it is a degenerative one. Allowing for individual variations, the radial side of the forearm may be assigned to the sixth, the index finger to the seventh, and the fifth finger to the eighth cervical nerve, and the ulnar side of the wrist and forearm to the

first thoracic nerve. Thus axon reflexes also indicate the distribution of the lesion.

The author suggests the following plan for the management of a case of complete traction lesion of the brachial plexus:

- (1) Accurate testing of motor power and sensibility as soon as possible, particular note being made of Horner's syndrome and pain.
- (2) About three weeks after injury electrical tests are carried out to confirm that the lesion is a degenerative one.
- (3) Six to eight weeks after injury motor power and sensibility are reassessed and axon responses tested.
 - (a) If all, or all but one, of the nerves have suffered a postganglionic lesion, exploration is indicated to determine whether there is a tear apart. If this is present reconstruction can be started without delay.
 - (b) In the case of a preganglionic lesion of two or more nerves the prognosis is bad enough to advise the patient that he is unlikely to regain useful function of the limb.

P. J. R. NICHOLS

A Clinical Study of Beat Knee. J. T. WATKINS, T. A. HUNT, R. H. P. FERNANDEZ, and O. P. EDMONDS. *Brit. J. industr. Med.*, 1958, 15, 105.

Beat-knee is defined in the First Schedule to the National Insurance (Industrial Injuries) (Prescribed Diseases) Regulations, 1948, as "a subcutaneous cellulitis or acute bursitis arising in or about the knee".

Of 899 cases of beat-knee from a large group of coal-miners studied by the authors, simple bursitis was found in 632 (70.3%), cellulitis over the front of the knee in 103 (11.5%), and combined bursitis and cellulitis in 164 (18.2%). Most cases occurred in men working at a seam height of less than 4 feet. Four types of knee pads were worn by coal-face workers, but without preventing beat-knee.

MAURICE F. HART

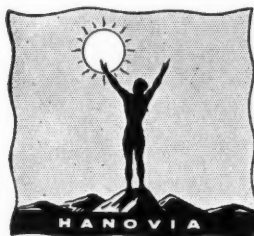
A Goniometer Designed for the Hand. H. R. NOER and D. R. PRATT. *J. Bone Jt Surg.*, 1958, 40A, 1154.

This short article describes a simple, practical, and useful goniometer. The apparatus is an adaptation of the familiar goniometers, but reads from 30 degrees of hyperextension to 120 degrees of flexion. The shaft is calibrated in inches, useful in determining by how much a digit fails to achieve full flexion or extension.

P. J. R. NICHOLS

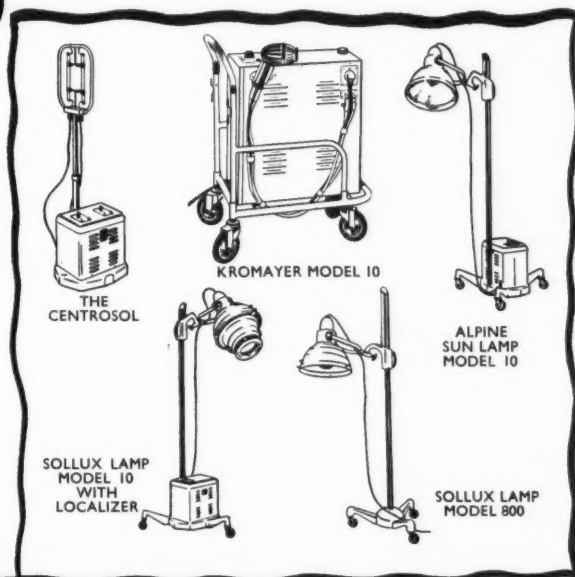
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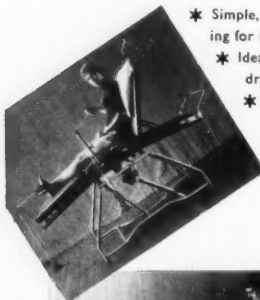
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